



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

MEMORANDUM

SUBJECT: Request for a Removal Action at the Sooner Dial Company Site, Custer County, Oklahoma

FROM: *Patrick L. Hammack*
Patrick L. Hammack, Senior On-Scene Coordinator
Site Response Section (6SF-R1)

TO: Myron Knudson, P.E. Director
Superfund Division (6SF)

THRU: Charles A. Gazda, Chief *Charles A. Gazda*
Response and Prevention Branch (6SF-R)

I. PURPOSE

This memorandum requests approval for a Removal Action pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, 42 U.S.C. § 9604, *et seq.*, at the Sooner Dial Company Site (Site) located in Clinton, Custer County, Oklahoma. The Site consists of the 1002 S. Tenth Street property where the Sooner Dial Company formerly operated, the Kite Shop located at 829 S. Tenth Street, and the surrounding residential and commercial properties where radium contamination has been found. The proposed action involves the excavation and off-site disposal of radium contaminated soil and the subsequent restoration of both the commercial and residential properties near the former facility.

This action meets the criteria for initiating a removal action under Section 300.415 of the National Contingency Plan (NCP), 40 CFR § 300.415. This action is anticipated to require less than twelve months and less than \$2 million to complete.

9527448



II. SITE CONDITIONS AND BACKGROUND

CERCLIS # OKD987096591

Category of removal: Time-Critical

Site ID # AB

A. Site Description

1. Removal site evaluation

The Sooner Dial Company Site is the residential and commercial area surrounding the former Sooner Dial Company facility (Attachment 1). The Sooner Dial Company facility is a $\frac{1}{4}$ acre property located in a commercial area of Clinton, Custer County, Oklahoma (Attachment 2). From the 1950's until 1969, the company refurbished aircraft instrument dials which contained radium-226 based luminous paint. The site is immediately adjacent to a resale shop and three residential properties. It was brought to the attention of the Environmental Protection Agency (EPA) Environmental Services Division (ESD) by the Oklahoma Department of Environmental Quality (ODEQ) in a January 27, 1994 letter from Mark Coleman to Russell Rhoades, Director of the ESD.

2. Physical location

The Site is located in the City of Clinton, Oklahoma, in the vicinity of Wilson and Tenth Streets. The actual Sooner Dial Company facility was located at 1002 S. Tenth Street. The rough boundary of the Site extends beyond the former Sooner Dial Company facility property to the adjoining properties to the south and west and across the street to 829 S. Tenth St. where the company continued to operate. Detailed maps and drawings of the Site are included in the administrative record.

The actual Sooner Dial Company facility consisted of two buildings. One of the buildings has been demolished and was taken to the Ray Wichert (CERCLIS # OKD987095049) property. The second building remains at 1002 S. Tenth Street and is the current location of an automobile repair shop. Sooner Dial Company also operated at 829 S. Tenth Street which was included in the site report as the Kite Shop.

3. Site characteristics

The Sooner Dial Company site was a facility which maintained aircraft instruments including the refinishing of instrument dials with radium-226 based luminous paint. The Sooner Dial Company began operation in 1950's and worked with Frank Say Airmotive, Inc., and/or Carruth Laboratories, Inc. at the 1002 S. Tenth Street address. Records indicate that the Sooner Dial Company actually performed the refinishing on dials provided by Frank Say Airmotive, Inc. and/or Carruth Laboratories, Inc.

The site building is currently occupied by an automobile body repair shop. The vacant lot adjacent to the automobile repair shop where the majority of the radium contamination exists is used to stage vehicles and automotive parts. A discount retailer occupies the building to the south of the vacant lot. Three residential properties are to the west of the site. A small area behind the Kite Shop is also contaminated.

As a result of the refinishing operations performed at the site, wide-spread Radium-226 soil contamination has been confirmed on the former facility property and on adjacent residential and commercial properties. The site area is not fenced and allows unrestricted access to the public.

4. Releases or threatened release into the environment of a hazardous substance, pollutant or contaminant

Releases of radium and radon have contaminated the approximately 1 acre of residential and commercial property within Clinton, Oklahoma. Radium and radon are listed hazardous substances as defined at Section 101(14) of CERCLA, 42 U.S.C. § 9601(14) and further defined at 40 CFR § 302.4.

In March and April, 1995, U.S. EPA investigations were conducted to determine exposure levels associated with gamma radiation at the site. Exposure and dose measurements were made using a Ludlum 19 Micro R meter and thermoluminescent dosimeters (TLDs). The gamma radiation survey indicated areas in excess of 650 micro roentgen per hour ($\mu\text{R/hr}$). National background concentrations in an uncontaminated area should have gamma reading between 10-15 $\mu\text{R/hr}$. Radon sampling was also conducted in several indoor locations. Radon is a gaseous daughter of radium disintegration. Results did not indicate significant accumulations of radon within indoor areas.

5. NPL status

This Site is not presently on the National Priorities List (NPL). The Oklahoma State Department of Health (OSDH) conducted a Preliminary Assessment at the site. Due to the limited waste quantity, the small size of the facility, and limited targets, the site was removed from consideration for NPL ranking. However, should the site be ranked on the NPL in the future, the current removal actions are consistent with any remedial cleanup that might be taken due to the fact that the proposed actions constitute source removal measures.

6. Maps, Pictures and other graphic representations

- Attachment 1** **Site sketch**
- Attachment 2** **Site location map**
- Attachment 3** **Oil & Hazardous Materials/Technical Assistance Database (OHM/TADS) Material Safety Data Sheets (MSDS) for Radium**
- Attachment 4** **Agency for Toxic Substances and Disease Registry Consultation.**
- Attachment 5** **Enforcement Addendum**

B. Other Actions to Date

1. Previous actions

Previous actions taken by or directed by Oklahoma State Department of Health (OSDH) are listed below. EPA has taken no previous response actions at the Site.

2. Current actions

There are currently no actions taking place on the Site.

C. State and Local Authorities' Roles

1. State and local actions to date

The facility has a long history of operational deficiencies identified during inspections by OSDH dating back to 1965. Additionally, the OSDH and reorganized State of Oklahoma Department of Environmental Quality (ODEQ) have performed site assessment activities, a PRP search and pursued a PRP cleanup of the site. After PRP negotiations were discontinued, ODEQ requested EPA assistance at the Sooner Dial Company Site.

2. Potential for continued State/local response

In a January 27, 1994 letter to Russell Rhoades, EPA Director of the Environmental Services Division, ODEQ Executive Director Mark Coleman requested EPA assistance in the evaluation and possible response action associated with contamination at the Sooner Dial Company Site. Additional response is expected by State and or local officials at the site in the form of monitoring the site conditions and community relations.

III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

A. Threats to Public Health or Welfare

The current conditions at the Site meet the following factors which indicate that the Site is a threat to the public health, welfare and the environment and a removal action is appropriate under Section 300.415(b)(2) of the National Contingency Plan, 40 CFR § 300.415(b)(2). Any or all of these factors may be present at a site yet any one of these factors may determine the appropriateness of a removal action.

1. Exposure to Human Populations, Animals or the Food Chain, NCP Section 300.415(b)(2)(i)

There is potential for exposure to human population as a result of radium contamination at the Sooner Dial Company site. Radium-226 is a radionuclide that emits ionizing radiation. Radium has a half-life of 1,620 years and a gaseous daughter, radon. Ionizing radiation has the potential for being a carcinogen, mutagen and teratogen, according to the Oil and Hazardous Materials/Technical Assistance Database (Attachment 3). Exposure of reproductive cells to ionizing radiation can cause gene mutations to occur in excess of the spontaneous mutation rate. Developmental defects have been observed in experimental animals exposed to ionizing radiation.

Human exposure can occur by one or more of the following mechanisms: 1) whole body tissue exposure from penetrating gamma radiation; 2) lung tissue exposure from the inhalation of radon; 3) lung tissue exposure from alpha-particles due to the inhalation of radium contaminated dust; and 4) digestive tract tissue exposure due to ingestion of radium contaminated soil. Gamma radiation levels at the site have been found at 650 μ R/hr, nearly 100 times background gamma radiation levels. Radium-226 concentrations have been found above the 5 picocuries per gram (pCi/g) action level in the vacant lot, alley and 2 residential properties. Sample results indicate radium-226 concentrations at 4,540 pCi/g within the vacant lot adjacent to the automobile body repair shop and three residential properties. Normal background radium concentration are approximately 1 pCi/g.

2. Contamination of Drinking Water Supplies or Sensitive Ecosystems, NCP Section 300.415(b)(2)(ii)

The radium contamination is within the City of Clinton, Oklahoma. All residences and businesses in the affected area are on city water.

3. Contaminants in Soils, NCP Section 300.415(b)(2)(iv)

Elevated levels of radium-226 are located in surface soils throughout the site and the adjacent businesses, alley and residential properties. Gamma radiation exposure can occur just by being in close proximity of the contaminated soils. Additionally, radium contaminated dust may be incidentally inhaled and/or ingested by humans especially with the hand-to-mouth behavior of young children playing in the contaminated residential lots.

4. Weather Conditions That May Cause the Release or Migration of Hazardous Substances, NCP Section 300.415 (b)(2)(v)

There is the potential of wind-borne migration of the dust containing elevated radium-226 concentrations. Oklahoma is known for its windy and dusty conditions which can accelerate contaminant migration.

5. Availability of Other Mechanisms, NCP Section 300.415 (b)(2)(vii)

By way of referral from ODEQ, EPA is be the only mechanism available to respond to the imminent and substantial endangerment posed by the hazardous substances located at the site. The State and local officials do not have the resources available to address the current situation. If other mechanisms become available during the response action, EPA will evaluate that mechanism as appropriate.

B. Threats to the Environment

There are no known threats to the environment relative to the elevated hazardous substances located in at the site.

IV. ENDANGERMENT DETERMINATION

Actual or threatened releases of hazardous substances, pollutants or contaminants from this Site, if not addressed by implementing the response action selected in this Action Memorandum, may present an imminent and substantial endangerment to the public health, welfare, or the environment.

V. PROPOSED ACTIONS AND ESTIMATED COSTS

A. Proposed Actions

1. Proposed action description

As discussed below, all of the actions to be taken on-site during this removal will comply with all applicable, or relevant and appropriate requirements (ARARs) to the extent practicable, considering the exigencies of the situation, and provide an effective mitigation of the imminent and substantial threats posed to the public health by the Site.

The proposed action involves the excavation and off-site disposal of all radium contaminated soil above 5 pCi/g to a depth of 15 cm and 15 pCi/g below 15 cm. All excavated areas will be backfilled with "clean" soil and brought back as close to its original contour and grade as practical. "Clean" soil is considered void of contaminants above background levels and will not constitute a health threat if used in a residential play area. Ground cover will be provided to "clean" backfill area to stabilize the soil and prevent erosion. Residential areas will be sodded with grass species present prior to excavation. The commercial areas of the site can either be sodded or seeded with grass. Landscaping plants removed during the removal action will be replaced with the best commercially available equivalent.

Off-site disposal will be accomplished by sending all radioactive contaminated soils to an appropriate disposal facility. All hazardous substances, pollutants or contaminants removed off-site pursuant to this action for treatment, storage, or disposal shall be treated, stored, or disposed of at a facility in compliance, as determined by EPA, pursuant to CERCLA Section 121(d)(3), 42 U.S.C. § 9621(d)(3), and the following rule: "Amendment to the National Oil and Hazardous Substances Pollution Contingency Plan; Procedures for Planning and Implementing Off-Site Response Action: Final Rule" 58 FR 49200 (September 22, 1993), and codified at 40 CFR § 300.440.

All containers to be sent off-site for disposal will be packaged and labeled in accordance with RCRA requirements found at 40 CFR §§ 262.30-32 and will be properly manifested in accordance with the requirements set out in 40 CFR §§ 262.20-23. All transportation will be in accordance with Department of Transportation rules and regulations. See generally 40 CFR § 263.

Other requirements under the Occupational Safety and Health Act (OSHA) of 1970, 29 U.S.C. § 651 et seq., and under the laws of the State with plans approved under Section 18 of the State's OSHA laws, as well as other applicable safety and health requirements, will be followed. Federal OSHA requirements

include, among other things, Hazardous Materials Operation, 20 CFR Part 1910, as amended by 54 Fed. Reg. 9317 (March, 1989), all OSHA General Industry (29 CFR Part 1910) and Construction (29 CFR Part 1926) standards wherever they are relevant, as well as OSHA record keeping and reporting regulations, and the EPA regulations set forth in CFR Part 300, relating to the conduct of work at Superfund sites.

2. Contribution to remedial performance

The proposed action is consistent with any conceivable remedial response since it will eliminate the source material and is expected to complete all necessary actions at the Site.

3. Description of alternative technologies

There are no alternative technologies which could feasibly be applied.

4. Applicable or relevant and appropriate requirements

The proposed removal action will be conducted to eliminate the actual or potential exposure to hazardous substance, pollutant or contaminant pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. § 9601 et seq., and in a manner consistent with the National Contingency Plan, 40 CFR Part 300, as required at 33 U.S.C. § 1321(c)(2) and 42 U.S.C. § 9605. As per 40 CFR Part 300.415(I), fund-financed removal actions under CERCLA Section 104, U.S.C. § 9604, and removal actions under CERCLA Section 106, U.S.C. § 9606 shall, to the extent practicable considering the exigencies of the situation, attain the applicable or relevant and appropriate requirements under Federal environmental law.

Due to the fact that consolidation and off-site disposal are the principal elements of this removal action, RCRA waste analysis requirements found at 40 CFR §§ 261.20 and 261.30, RCRA manifesting requirements found at 40 CFR § 262.20, and RCRA packaging and labeling requirements found at 40 CFR § 262.30, are deemed to be appropriate requirements for this removal action. National Ambient Air Quality Standards (NAAQS) found at 40 CFR § 50 will be used, as applicable, to protect the quality of air during the implementation of the action.

There are no regulatory cleanup standards directly applicable to the site. The site cleanup level for both the residential and commercial areas of the site are 5 pCi/g down to 15 cm soil depth and 15 pCi/g below 15 cm. The 5/15 pCi/g action level for the Sooner Dial site has been accepted by the Agency for Toxic Substances and Disease Registry (ATSDR) (Attachment 4). The Oklahoma Department of Environmental Quality also approves of the site cleanup level.

5. Project Schedule

The excavation, disposal of contaminated soil and restoration of the properties will last approximately two months. In order to take advantage of the warm dry weather, it will be necessary to start the project prior to September.

B. Estimated Costs

Extramural Costs

ERCS	\$ 915,000
TAT	\$ 101,300
Subtotal, Extramural Costs	\$ 1,016,300
Extramural Costs Contingency (20%)	\$ 203,200
TOTAL, EXTRAMURAL COSTS	\$ 1,219,500

Intramural Costs

EPA Direct Costs	\$ 52,200
EPA Indirect Costs	\$ 104,400
TOTAL, INTRAMURAL COSTS	\$ 156,600
TOTAL, REMOVAL PROJECT CEILING	\$ 1,376,100

VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

If action is not taken at the Site, the residents and, in particular, the children playing in the yards will continue to be exposed to the gamma radiation and radium contaminated soil. As cited above, such exposure could possibly lead to adverse health effects including cancer.

VII. OUTSTANDING POLICY ISSUES

There are no outstanding policy issues associated with this Site.

VIII. ENFORCEMENT

See Attachment 5.

IX. RECOMMENDATION

This decision document represents the selected removal action for the Sooner Dial Company Site, in Custer County, Oklahoma, developed in accordance with CERCLA as amended, and not inconsistent with the NCP. This decision is based on the administrative record for the Site.

Conditions at the Site meet the criteria as defined by Section 300.415(b)(2) of the NCP, 40 CFR § 300.415(b)(2), for a removal, and I recommend your approval of the proposed removal action. The total project ceiling, if approved, will be \$1,376,100 of this, an estimated \$915,000 comes from the Regional removal allowance.

APPROVED

Mr. P. K. Smith

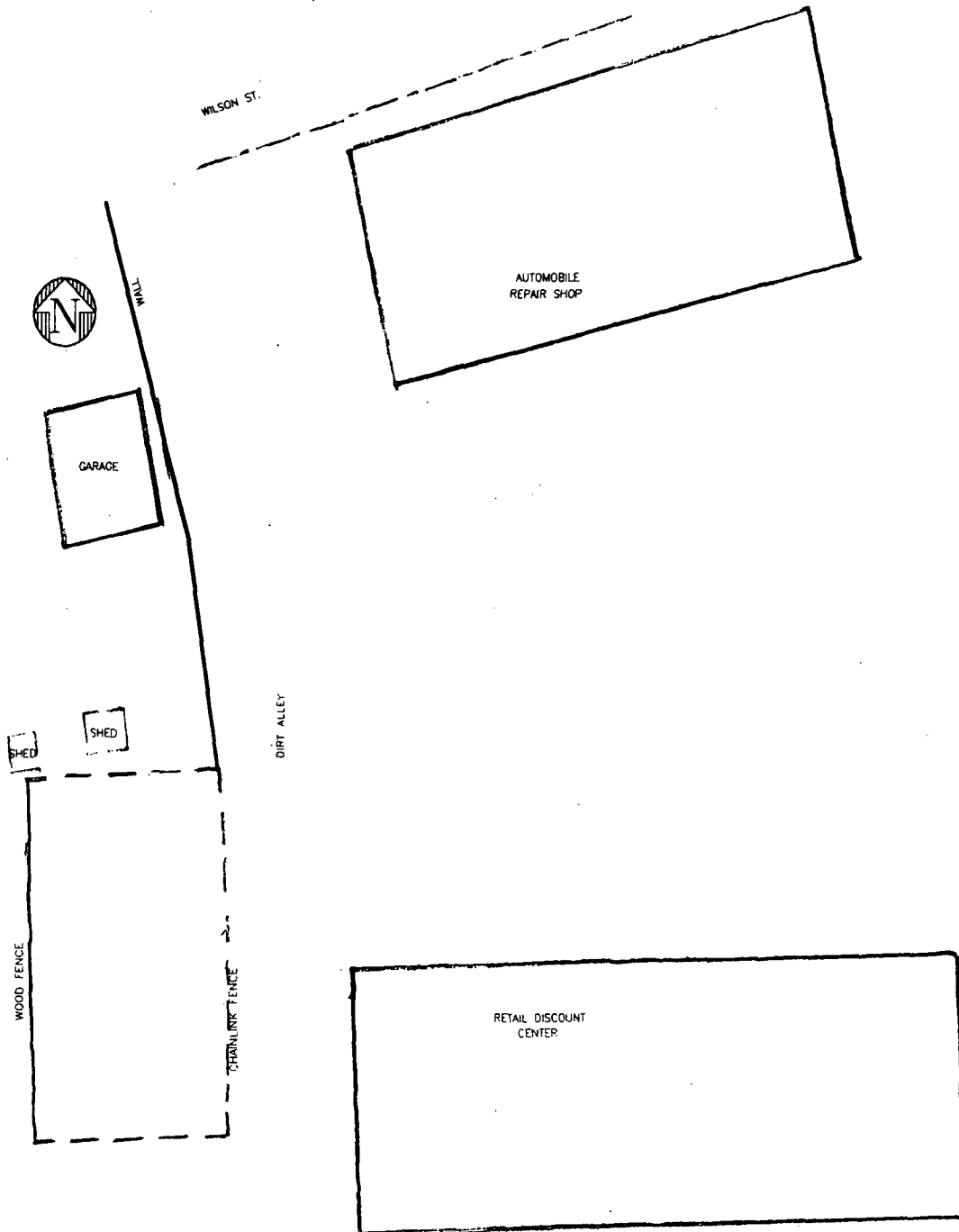
DATE:

8/22/96

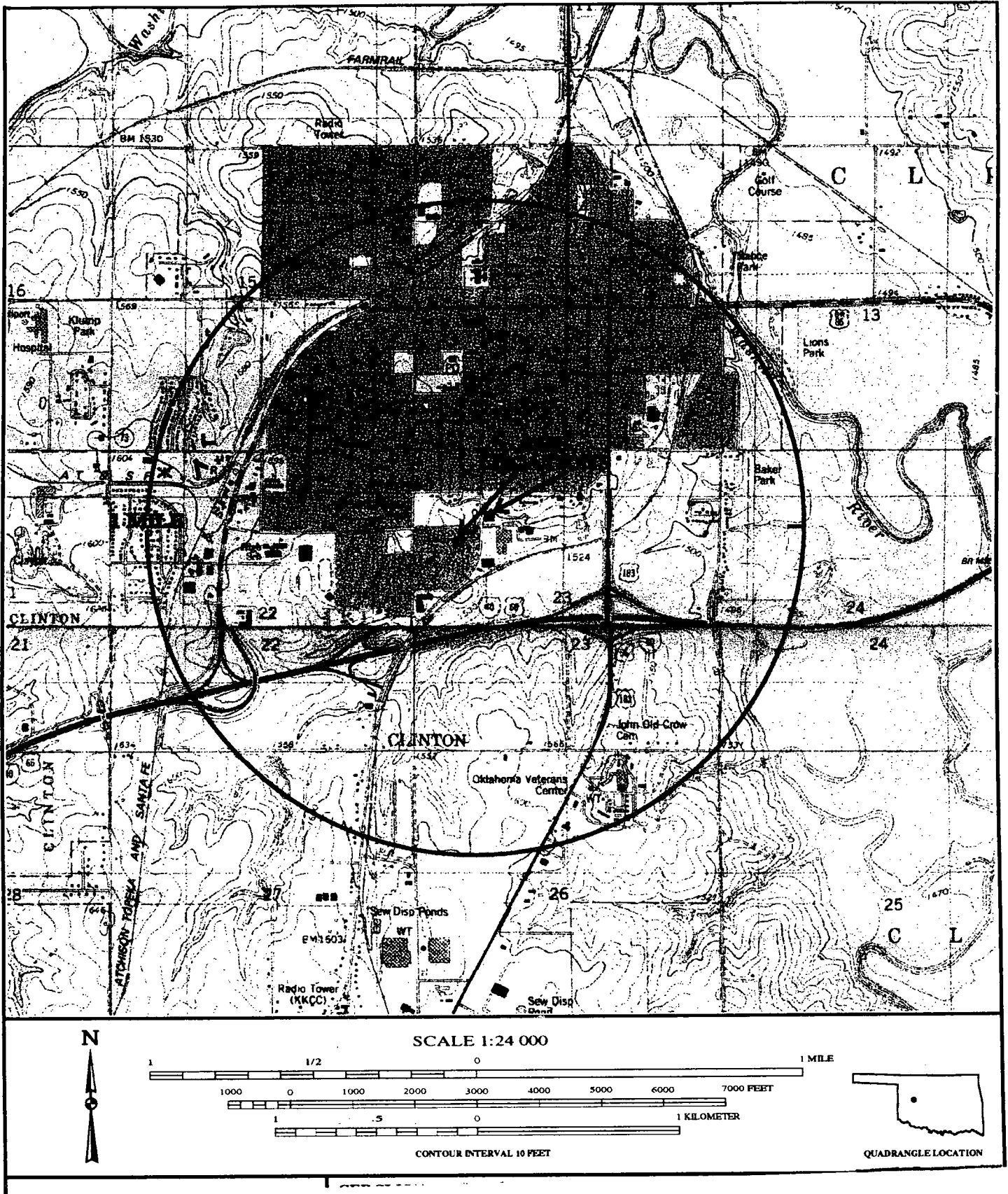
DISAPPROVED

DATE:

ATTACHMENT 1



ATTACHMENT 2



ATTACHMENT 3

File 2; Entry 1; Accession No. 7217165

- (CAS) CAS Registry Number: 0103090802-0603-03
(SIC) SIC Code: 2819
(MAT) Material Name: RADIUM 226
(SYN) Synonyms: RADIOACTIVE RADIUM
(FML) Chemical Formula: RA
(USS) Common Uses: LUMINOUS PAINT
(STO) General Storage Procedures: .1 UC EXEMPT FROM LICENSING.
(HND) General Handling Procedures: CFR TRANSPORT GROUP I-TYPE A MAX QUANTITY .001 CI AND TYPE B MAX QUANTITY 20 CI-TYPE A QUANTITY MAY BE PACKAGED FOR SHIPMENT VIA AIR, HIGHWAY, RAIL OR WATER IN FIBERBOARD BOXES AND DRUMS, METAL DRUMS AND WOODEN BOXES, TYPE B IN METAL DRUMS. THE TOTAL CONTENT OF RADIOACTIVE MATERIAL DOES NOT EXCEED .0001 CI PER DEVICE AND .001 CI PER PACKAGE FOR MANUFACTURED ARTICLES HAVING RADIOACTIVE MATERIALS, OTHER THAN LIQUID FORM, IN NONDISPERSIBLE FORM.
- (PRD) Production Sites: AMERSHAM/SEARLE CORP., ARLINGTON HEIGHTS., IL;
ATOMIC CORP. OF AMERICA, SUN VALLEY, CA;
BAIRD-ATOMIC, INC., BEDFORD, MA;
BIONUCLEAR, HOUSTON, TX;
CANRAD PRECISION INDUSTRIES, INC., PELHAM, NY;
HIGH NUCLEAR, INC., HOUSTON, TX;
HIGH VOLTAGE ENGINEERING CORP., BURLINGTON, MA;
INTERNATIONAL CHEMICAL AND NUCLEAR CORP., IRVINE, CA;
IN-VAL-CO, TULSA, OK;
ISOTOPE PRODUCTS LABORATORIES, BURBANK, CA;
NATIONAL BUREAU OF STANDARDS, WASHINGTON, DC;
NEW ENGLAND NUCLEAR CORP., BOSTON, MA;
NUCLEAR RADIATION DEVELOPMENTS, INC., GRAND ISLAND, NY;
RADIATION MATERIALS CORP., WALTHAM, MA;
RADIUM CHEMICAL CO., INC., NEW YORK, NY;
TELEDYNE ISOTOPES, PALO ALTO, CA;
TRACERLAB, WALTHAM, MA;
UNIVERSAL RADIOISOTOPES, INC., RICHMOND, CA.
- (FDL) Detection Limit (Field; Techniques, Ref) (ppm): 1.E-5, GAMMA, (C15*** 0001).
- (LDL) Detection Limit (Lab.; Techniques, Ref) (ppm): LESS THAN MPC IN WATER, GROSS ALPHA AND GROSS BETA COUNTING, SAMPLE MAY REQUIRE CONCENTRATION BY DISTILLATION OR OTHER MEANS, (C16*** 0001).
- (STD) Standard Codes: LABELS FOR PACKAGES OF RADIOACTIVE MATERIALS MUST BE OF DIAMOND SHAPE, IN COLORS SPECIFIED, WITH EACH SIDE AT LEAST 4 INCHES LONG. PRINTING MUST BE IN BLACK INSIDE A BLACK LINE BORDER MEASURING AT LEAST 3 1/2 INCHES ON EACH SIDE. "RADIOACTIVE WHITE-I" LABEL -- LABEL MUST BE WHITE IN COLOR. THE SINGLE VERTICAL BAR ON THE LOWER HALF OF THE LABEL MUST BE BRIGHT RED IN COLOR. LABELS MUST BE APPLIED ON TWO OPPOSITE SIDES OF EACH PACKAGE HAVING A DOSE RATE NOT EXCEEDING .5 MILLIREM PER HOUR AT ANY POINT ON THE EXTERNAL SURFACE OF THE PACKAGE. NOT AUTHORIZED FOR FISSILE CLASS II PACKAGES. "RADIOACTIVE YELLOW-II" LABEL -- THE UPPER HALF OF THE LABEL MUST BE BRIGHT YELLOW AND THE BOTTOM HALF MUST BE WHITE. THE TWO VERTICAL BARS ON THE LOWER HALF OF THE LABEL MUST BE BRIGHT RED IN COLOR. LABELS MUST BE APPLIED ON TWO OPPOSITE SIDES OF: A) EACH PACKAGE HAVING A DOSE RATE NOT EXCEEDING 10 MILLIREM PER HOUR AT ANY POINT ON THE EXTERNAL SURFACE OF THE PACKAGE AND NOT EXCEEDING .5 MILLIREM PER HOUR AT 3 FEET FROM THE EXTERNAL SURFACE OF THE PACKAGE; OR B) EACH PACKAGE FOR WHICH THE TRANSPORT INDEX DOES NOT EXCEED .5 AT ANY TIME DURING TRANSPORTATION. "RADIOACTIVE YELLOW-III" LABEL -- THE UPPER HALF OF THE LABEL MUST BE BRIGHT YELLOW AND THE BOTTOM HALF MUST BE WHITE. THE THREE VERTICAL BARS ON THE LOWER HALF OF THE LABEL MUST BE BRIGHT RED IN COLOR. LABELS MUST BE APPLIED ON TWO OPPOSITE SIDES OF: A)

EACH PACKAGE HAVING A SURFACE DOSE RATE EXCEEDING 10 MILLIREM PER HOUR;
 B) EACH FISSIONABLE CLASS III PACKAGE; C) EACH PACKAGE CONTAINING A LARGE
 QUANTITY OF RADIOACTIVE MATERIAL AS: 20 CURIES OF GROUP I RADIONUCLIDES,
 20 CURIES OF GROUP II RADIONUCLIDES, 200 CURIES OF GROUP III
 RADIONUCLIDES, 200 CURIES OF GROUP IV RADIONUCLIDES, 5,000 CURIES OF
 GROUP V RADIONUCLIDES, 50,000 CURIES OF GROUP VI RADIONUCLIDES, 500,000
 CURIES OF GROUP VII RADIONUCLIDES, OR 5,000 CURIES OF SPECIAL FORM
 RADIOACTIVE MATERIALS; OR D) EACH PACKAGE TRANSPORTED UNDER A SPECIAL
 PERMIT ISSUED IN RESPONSE TO A PETITION.

- (TCP) Toxic Combustion Products: RADIOACTIVE COMBUSTION PRODUCTS
 (EXP) Explosiveness: NONFISSIONABLE
 (MLT) Melting Point (C.): 960
 (BLP) Boiling Point (C.): 1140
 (SLC) Solubility Characteristics: DECOMPOSES
 (SPG) Specific Gravity: 5
 (PER) Persistency: 1602 YEAR RADIOACTIVE HALF-LIFE; BIOLOGICAL HALF-LIVES OF
 8100 DAYS IN TOTAL BODY, 16000 DAYS IN BONE, AND 10 DAYS IN KIDNEYS AND
 LIVER.
 (PFA) Potential for Accumulation: THE CONCENTRATION OF RADIONUCLIDES IN
 AQUATIC AND MARINE ORGANISMS IS GOVERNED BY THESE FACTORS: 1) THE
 PARTICULAR ELEMENT INVOLVED AND ITS PHYSIOLOGICAL IMPORTANCE TO THE
 ORGANISM, 2) THE PHYSICAL AND CHEMICAL STATE OF THE ELEMENT AND ITS
 POSITIVE; ACCEPTABILITY TO THE SPECIFIC ORGANISM, 3) THE CONCENTRATION OF
 THE ELEMENT IN THE ENVIRONMENT AND THE PRESENCE OF OTHER ELEMENTS THAT
 MAY INHIBIT OR ENHANCE ITS UPTAKE, 4) THE MORPHOLOGY OF THE ORGANISM, ITS
 LIFE HISTORY, ITS CONDITION AND AGE, AND ITS PARTICULAR ROLE IN THE FOOD
 WEB, AND 5) THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE ENVIRONMENT.
 (FOO) Food Chain Contamination Potential: POSITIVE
 (CAG) Carcinogenicity: IONIZING RADIATION HAS THE POTENTIAL FOR BEING
 CARCINOGENIC.
 (MUT) Mutagenicity: EXPOSURE OF SEX CELLS TO IONIZING RADIATION CAN CAUSE
 GENE MUTATIONS TO OCCUR IN EXCESS OF THE SPONTANEOUS MUTATION RATE.
 POTENTIAL.
 (TER) Teratogenicity: DEVELOPMENTAL DEFECTS HAVE BEEN OBSERVED IN
 EXPERIMENTAL ANIMALS EXPOSED TO IONIZING RADIATION. POTENTIAL.

(FTB) Fresh Water Toxicity Text:

Conc.	Expos (Hr)	Specie	Effect	Test Environment	Reference
8000 25000		ALGAE "	TLM 100% MORTALI TY		(R) CWQPAV 0001 "
10000 18000		PROTOZOA "	TLM 100% MORTALI TY		" "
5000 10000		MOLLUSKS "	TLM 100% MORTALI TY		" "
500 5000		CRUSTACEA "	TLM 100% MORTALI TY		" "
600 2500	1344	FISH RAINBOW TROUT	TLM ALL KILLED		" "

(ATB) Animal Toxicity Text:

Value	Time	Soecies	Param.	Route	Reference
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1400 R/10 R/DAY 6 DAY/W EEK 3500 R/10 R/DAY 6 DAY/W EEK 4400 R/8.8 R/DAY 2300 R/8.8 R/DAY	DOG RAT MUS GPG	LD50 " " "	ORL " " "	CWQPAV 0001 " " "
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- (LVN) Livestock Toxicity (ppm): 200
(LVR) Livestock Toxicity (Reference): WARM BLOODED, (R) (CWQPAV 0001)
(TRT) Major Species Threatened: ALL SPECIES
(INH) Inhalation limit (value): .2E-11
(INT) Inhalation Limit (Text): REGULATIONS-- NUCLEAR REGULATORY COMMISSION
PERMISSIBLE LEVELS (UNRESTRICTED AREAS): 3E-12 CI/M3 (SOLUBLE COMPOUNDS)
(10CFR* 20) 2E-12 CI/M3 (INSOLUBLE COMPOUNDS) (10CFR* 20) UPDATED 3/84
(IRL) Irritation Levels (Value): .0000001
(IRT) Irritation Levels (Text): UC/CC
(DRC) Direct Contact: REFER TO SPECIFIC COMPOUND
(MOR) Odor Threshold, Medium (Reference): REFER TO SPECIFIC COMPOUND
(MTR) Taste Threshold, Medium (Reference): REFER TO SPECIFIC COMPOUND
(DRK) Recommended Drinking Water Limits (ppm): .00000001
(DRR) Recommended Dringing Water Limits (Reference): (UC/ML) (C20*** 0001)
(BCE) Body Contact Exp. (ppm): .00000001
(BCR) Body Contact Exp. (Reference): (UC/ML) (C20*** 0001)
(SAF) Personal Safety Precautions: ALPHA AND GAMMA RADIATION DO NOT ALLOW
CONTAMINATED WATER TO COME IN CONTACT WITH SKIN OR PERSONAL CLOTHING.
WEAR WATERPROOF PROTECTION. IF RADIOACTIVITY IS ALSO AIRBORNE, A MASK
WITH AIR FILTER MAY BE REQUIRED.
(AHL) Acute Hazard Level: SOLUBILITY: ORGAN MPB IN 40 HOURS WEEK 168 HOURS
WEEK OF TOTAL BODY UC/CC UC/CC REFERENCE (UC) MPC/W MPC/A MPC/W MPC/A
BONE / .1 / .00000004 / .000000000003 / .0000001 / .000000000001 TOTAL BODY / .2
/ .00000006 / .000000000005 / .00000002 / .000000000002 GI / / .001 / .00000003 / .0005
/ .00000001 INSOLUBILITY: GI / / .0009 / .00000002 / .0003 / .000000006
(HEL) Degree of Hazard to Public Health: HIGH, DUE TO EXPOSURE TO RADIATION
(AIR) Air Pollution: RADIOACTIVE HIGH
(ACT) Action Levels: NOTIFY LOCAL AIR AUTHORITIES AND THE NUCLEAR REGULATORY
COMMISSION. DO NOT ENTER WITHOUT RADIATION MONITOR.
(AML) In Situ Amelioration: CATION EXCHANGE RESIN, OR ALUMINUM SULFATE, OR
FERRIC SULFATE. SEEK PROFESSIONAL ENVIRONMENTAL ENGINEERING ASSISTANCE
THROUGH EPA'S ENVIRONMENTAL RESPONSE TEAM (ERT), EDISON, NJ, 24-HOUR NO.
201-321-6660.
(SHR) Beach/Shore Restoration: REMOVE THE SAND AND BURY AT AUTHORIZED BURIAL
SITE.
(AVL) Availability of Countermeasure Materials: CATION EXCHANGE RESIN -
WATER SOFTENING AND CONDITIONING SUPPLIERS, WATER TREATMENT PLANTS;
ALUMINUM SULFATE, ALSO KNOWN AS ALUMINA SULFATE OR FILTER ALUM, - WATER
TREATMENT PLANTS; FERRIC SULFATE, ALSO KNOWN AS FERRISUL AND FERRIFLOC, -

WATER TREATMENT PLANTS.

- (DIS) Disposal Methods: BURIAL AT AN AUTHORIZED RADIOACTIVE BURIAL SITE.**
- (DSN) Disposal Notification: CONTACT THE NUCLEAR REGULATORY COMMISSION**
- (IFP) Industrial Fouling Potential: THE SAFE RADIATION LEVELS ARE BELOW INDUSTRIAL FOULING POTENTIAL LEVELS.**
- (WTP) Effects on Water Treatment Processes: 1. POSSIBILITY OF BUILD-UP OF RADIOACTIVITY IN WATER TREATMENT SLUDGE OR FILTERS. 2. POSSIBILITY OF BUILD-UP OF RADIOACTIVITY IN SEWAGE TREATMENT SLUDGE. 3. POSSIBLE TOXIC EFFECT ON SEWAGE TREATMENT BACTERIA.**
- (WAT) Major Water Use Threatened: ALL WATER USES**
- (LOC) Probable Location and State of Material: 1. PURE ELEMENT IS A BRILLIANT WHITE METAL. 2. MOST COMPOUNDS ARE SOLUBLE IN WATER IN MOST CASES WILL DISSOLVE.**
- (DRT) Soil Chemistry: RADIATION LIMITS ARE BELOW SOIL TRANSFORMATION LIMITS.**
- (DAT) Adequacy of Data: GOOD**



55/55-2 P1 2:11
LAW...

Agency for Toxic Substances
and Disease Registry
Atlanta GA 30333

**Health Consultation
Sooner Dial Company
Clinton, Custer County, Oklahoma**

**Federal Facilities Assessment Branch
Division of Health Assessment and Consultation**

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BACKGROUND AND STATEMENT OF ISSUES

The Environmental Protection Agency (EPA), Region VI is proposing to remove radium contaminated soils to a level of 0.185 becquerels (5 picocuries)¹ per gram (Bq/g, pCi/g) within the top 15 centimeters (cm) of soil and 0.55 Bq/g (15 pCi/g) at depths greater than 15 cm. EPA requested that the Agency for Toxic Substances and Disease Registry (ATSDR) review current radiological health data to determine if the proposed cleanup levels for the Sooner Dial Company are protective of public health.

The Sooner Dial Company consists of two locations. The original facility, at 1002 South Tenth Street, consisted of two buildings where during the 1940s, the company refurbished aircraft dials by stripping and repainting the dials with radium-226 (Ra-226) containing paints. The second location is at 829 South Tenth Street. All activities at these sites ceased in 1969; one building at 1002 South Tenth Street was demolished in 1984 with the rubble transported to a disposal site in Clinton, Oklahoma. Residual radioactive contamination still exists at the 829 South Tenth Street location. Current activities at the 1002 South Tenth Street location include an automobile repair shop and 5 residences are within 200 feet of the site. A retail strip mall is near the 829 South Tenth Street site and a discount retailer is adjacent to the 1002 South Tenth Street site.

¹This health consultation is using the SI units for radiation values. The Becquerel (Bq) replaces the curie (Ci) in this system. One Ci equals 37 billion Bq.

Site radiological investigations have included gamma radiation measurements, radon determinations and soil determination of Ra-226. The soil analysis results indicate that Ra-226 concentrations ranged from background (0.044Bq/g) to over 148 Bq/g in the first 6 inches (15 cm). The EPA is proposing the removal of the contaminated soils to achieve a 0.185 Bq/g Ra-226 concentration in the top 15 cm of soil.

Currently, no federal regulations exist for regulating levels of radioactivity in soils except at uranium mill tailing sites. At the tailings sites, federal regulations state that radium cannot exceed 5 pCi/g in the top 15 cm of soils and 15 pCi/g in any 15 cm. This limit is to ensure that radon emissions do not exceed 20 pCi per square meter per second from the tailings piles (40 CFR 192; EPA, 1982).

To determine if the 0.185 Bq/g cleanup at the Sooner Dial Company is protective of public health, two major pathways serve as the exposure pathways of concern. These are exposure to gamma radiation and ingestion of Ra-226 contaminated soils. Inhalation is not considered a viable pathway once remediation is completed. In determining the dose from ingestion, two parameters must be evaluated. Firstly, the International Commission on Radiological Protection (ICRP) dose factors only include the radionuclide taken into the body. As the decay products accumulate in the body, the dose arising from those radionuclides is included in the dose factors. Secondly, because Ra-226 in the soil at the Sooner Dial Company site contains decay products, ingestion of soil must include those decay products. Radium-226 decay produces 8 progeny including Radon-222 (Rn-222) and 7 radioactive metal ions -- 3 polonium, 2 bismuth, and 2 lead radionuclides. For internal deposition, only Ra-226, polonium-210 (Po-210) and lead-210 (Pb-210) have sufficiently long radiological half-lives to contribute significantly to the internal dose.

Internal Exposure

The critical organ affected by Ra-226 and Pb-210 deposition is the bone surface; whereas, the critical organs for Po-210 are the kidney for infants and the kidney or spleen for other age groups (ICRP, 1994). Table I gives the ingestion dose to the whole body, bone surface, kidney, and spleen for several age groups.

Table I. Age specific doses following ingestion of 0.185 Bq of Ra-226+Decay products¹

	3 month	1 year	5 year	10 year	15 year	adult
Whole body	6	2	1	<1	<1	<1
Bone dose from Ra-226 and Pb-210	42	12	10	16	31	7

Kidney/Spleen dose from Po-210	26	14	8	5	3	2
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Data Source - Values derived from ICRP Publication 67 (ICRP, 1994)

1. Assumes an acute ingestion intake of 1 gram of contaminated soils containing radium-226, polonium-210, and lead-210. Chronic doses may be less because rapid changes to body mass during the formative years. The dose in microsieverts (0.1 millirem) is rounded to the nearest whole number and is integrated to 70 years of age.

External Exposure

External exposure to Ra-226 contaminated soil may be the more hazardous of the exposure pathways as ionizing radiation can easily pass through many substances. Furthermore, since the Ra-226 has been in place for about 40 years, the Ra-226 decay products can contribute to the overall exposure and dose. The external dose rates vary depending on distribution in the soils. The estimates of exposure from surface contamination, 1 cm depth, 5 cm depth, and 15 cm depth are in Table II. External exposure from 0.56 Bq/g at depths greater than 15 cm to do not contribute considerably to this dose as the 15 cm of soil serves as radiation shielding reducing the external radiation from the 0.56 Bq/g by at least 50%.

Table II. Estimates of annual external exposure rates to Ra-226 and decay products in contaminated soils for specific depths¹.

	Surface ²	1 centimeter	5 centimeters	15 centimeters
Exposure Rate ³	680	170	380	580

Data derived from Federal Guidance #12, EPA (1993).

1. Ra-226 and its decay products are taken to be uniformly distributed throughout the volume of soils and the decay products approach equal activity concentrations.
2. Exposure rate is a yearly dose per square centimeter of contaminated area.
3. Annual estimated dose is in microsieverts (0.1 millirem) and to the whole body.

DISCUSSION

The ICRP currently recommends limiting the intake of Ra-226 by workers to 90,000 Bq per year via ingestion and 9,000 Bq per year via inhalation. Intake of these amounts will impart an internal dose of 20 millisieverts² (mSv) per year (ICRP, 1991). Workers would have to ingest over 480 kilograms of soil or inhale 48 kilograms to reach this recommended limit. Radiation exposure regulations of the

²The SI unit of radiation dose is the sievert (Sv) which replaces the rem. One Sv equals 100 rem.

Nuclear Regulatory Commission (NRC) for workers in the U.S. limit workers to an annual dose total effective dose equivalent (internal and external dose) equal to 50 mSv (10 CFR 20.1201). The amount of soil ingested or inhaled would increase accordingly.

To limit the public dose to 1 mSv per year, the intakes based on ICRP values would be 4,500 Bq for ingestion and 450 Bq for inhalation. To reach this level of ingestion or inhalation, an individual would have to ingest over 24 kilograms of soil a year or inhale over 2.4 kilograms of soil. For a one-time ingestion of 1 gram of Ra-226 contaminated soil containing 0.185 Bq (5 pCi) from this site would impart a dose of 41 microsieverts, well below the recommended limit of 20 mSv and below the international guideline of 1 mSv. The NRC also limits exposures and doses to members of the public such that the total effective dose equivalent to individual members of the public from a licensed operation does not exceed 1 mSv (100 millirem) in a year (10 CFR 20.1301). This value for public exposure is also recommended by the ICRP (ICRP 60) and the National Council on Radiation Protection and Measurements (NCRP 116).

The doses thus far discussed are the result of a one time, acute ingestion dose resulting from the intake of 1 gram of soil containing 0.185 Bq. However, the exact doses resulting from chronic intake of soil may be less because rapid changes to body mass during the formative years. For example, in the case of a 1 to 2 year-old pica child who consumes 100 milligrams of soil containing 0.185 Bq/g on a daily basis, the estimated internal dose from this soil would be about 0.7 mSv during one year, still below the limiting value of 1 mSv.

However, in comparing the radiation doses possible from a cleanup level of 0.185 Bq/g in the top 15 cm of soil at the Sooner Dial Company, the total dose (external and internal) is dominated by the external dose component and thus becomes the limiting factor. If the Ra-226 and its decay products are limited to the proposed level, the annual total dose (Table II, 0.58 mSv) would be less than the annual dose limit of 1 mSv recommendation of the ICRP and the NCRP.

No adverse health effects have even been associated with long term exposure to 1 mSv of ionizing radiation per year. Using the most recent radiological risks developed by the EPA (EPA, 1994), a dose of 1 mSv would equate to an annual cancer risk of approximately 5.1×10^{-5} and a lifetime risk (70 years) of 4×10^{-3} . Current lifetime estimates for cancer resulting from background radiation exposure are about 1 in 100 (1×10^{-2}).

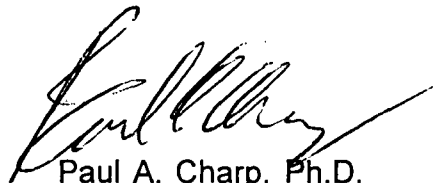
CONCLUSIONS

Based on the analysis of both internal deposition and external exposure to ionizing radiation resulting from Ra-226 and its decay products, ATSDR believes the proposed cleanup standard of 0.185 Bq/g (5 pCi/g) in the top 15 centimeters of soil and 0.56 Bq/g at or below 15 cm are protective of public health.

RECOMMENDATIONS

During the remediation of these sites, ATSDR recommends the following actions:

1. Because of the concern of external radiation exposure from Ra-226, a radiological health and safety plan should be followed closely. This would include an on-site health physicist or adequately trained health physic technician.
2. Appropriate dust control measures are necessary to prevent wide-spread contamination.
3. Consideration should be given to protect the health and safety of nearby residents and residential areas during the remediation.



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